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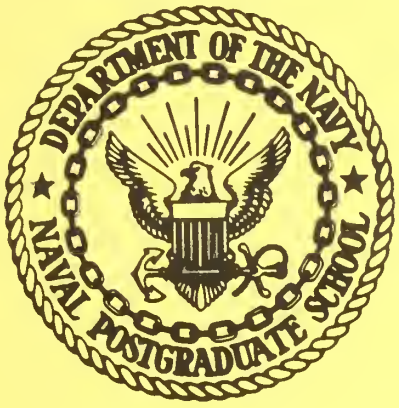

ACTIVITY LEVELS AND AIRCRAFT TYPES IN JET PROFICIENCY FLYING (CRT) AT NALF MONTEREY -- FIRST INTERIM REPORT, DATA ACQUISITION AT FOUR HOURS PER MONTH IN THE T-1A AIRPLANE

by

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ABSTRACT

Methods were developed for the collection of data with respect to the knowledge, skill, and satisfaction of aviators in combat readiness training (CRT). The methods are described and data pertaining to aviators flying the T-1A aircraft at the rate of forty-eight hours per year is given.

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENTS

The author is indebted to his collaborators. The study was a team effort and each collaborator was a generous and creative contributor. Acknowledgement is also gratefully given to CAPT F. H. Burnham, Deputy Superintendent of the Naval Postgraduate School, and to CDR F. R. Fuller, LCDR F. L. Moody, LT R. F. LaRochelle and AC3 Paul Johnston, all of the Naval Auxiliary Landing Field, Monterey, for their support and material assistance.

I. BACKGROUND

1.1 THE CRT PROGRAM

Combat Readiness Training (CRT) is the title of the proficiency flying program within the Naval Service, and, as such, is applicable to both the Navy and Marine Corps. Based on public law [8][1], executive order [9], and Navy directive [6], the CRT program has been established with the goals, "... to maintain ... basic aeronautical skill ...", for those aviators and naval flight officers assigned to shore or sea-based billets where tactical, operational flying is not required. Without such a program, most professional aviators would be, in effect, grounded during assignments to ship's company, staff, station, or school duty.

The CRT program, before recent changes, specified a total of 100 flying hours per aviator per year with minimum night and instrument flying requirements to be accomplished within the 100 hours limit. Beyond these specifications, the program has relied on stipulated NATOPS requirements for each aircraft type and local cognizance to provide guidance in the conduct of proficiency flying. CRT has been largely a self-taught program using obsolescent trainers and used-up operational aircraft, operating from bases where staffing and supply support are significant problems. At the present time, there are approximately 5300 aviators and 1100 Naval flight officers in the CRT program, a program whose annual cost is nearly $100 million.

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[1] refers to document number in bibliography.

1.2 PROBLEMS IN THE CRT PROGRAM

With recent military funding cuts and inquiry by the General Accounting Office (GAO), the CRT program has come under close scrutiny. As part of the Project 703 military budget cutback, the CRT program was reduced to 48 flying hours per year for the second half of FY 70. This temporary 50% reduction in flying hours was recently extended to all of FY 71 [10]. GAO entered the CRT problem when it asked the Secretary of Defense if proficiency flying was required for full-time officer students (with particular reference to the Naval Postgraduate School (NPS) and NALF Monterey).

For several reasons, NPS and NALF Monterey became the focal point of CRT program study efforts. The GAO question directly involved NPS and NALF Monterey, among others; NPS has a current aviator enrollment of nearly 500 and NALF Monterey exists solely to provide proficiency flying for these aviator students. Further, NPS faculty and students represent an in-house source of 'analytical talent' and there were insufficient resources in the CNO study program to support another CRT Study. Finally, there was a plan to use NALF Monterey to evaluate the use of leased, off-the-shelf, modern business jet aircraft in the CRT program. For these reasons, NPS was brought into the CRT study effort in January, 1970, and became actively engaged in April.

The principal questions, which ultimately must be convincingly answered, are:

1. Is the CRT program necessary?
2. If the program is necessary, what is the optimal program structure in terms of hours flown, aircraft employed, use of simulators, etc.; and
3. Is CRT flying required for officers while they are full-time students?

Early study efforts defined a number of problems within the CRT program [5]. A basic problem is that the program has no well-defined goals or objectives. The stated objective is "to maintain basic aeronautical skill", but this statement lacks precision. For example, a typical question is whether basic aeronautical skill can be maintained by flying four hours per month, or whether eight hours per month is required. It seems clear that no real answer to this question can be obtained until "basic aeronautical skill" is further defined in terms of specific skills and tasks, until the processes for the development and maintenance of these skills and tasks are understood, and until the contribution of flying a given aircraft at a given rate, over a given time period, and under specific conditions, are determined.

1.3 LITERATURE

A survey of the literature relating to proficiency flying yielded only two recent studies. The LTV Study [27, 28] and the PRC Study [15] both indicate that there are no existing, absolute measures of effectiveness for the CRT program. In both cases, the kinds of proficiency considered were not easily or effectively quantified because they are ill-defined.

The LTV Study concerned itself primarily with a questionnaire administered to a group of aviators which dealt with questions regarding retention in the service if the CRT program was abolished. The value of the CRT program was then quantified by compiling the cost of training replacements for those aviators who indicated that they would resign in such circumstances. The main result of the study rests on the subjective opinions of a group of aviators not immediately faced with such an occurrence as cancellation of the CRT program. Some have expressed reservations about the method and conclusions drawn from this study [34].

The study conducted by PRC under the auspices of OSD(SA) addressed the problem more rigorously. But PRC assumed initially that CRT flying was necessary, and proceeded from there to partially describe the structure of an optimal CRT program.

Additional studies concerning proficiency flying, human factors, and related subjects are listed in the annotated bibliography of this report.

1.4 PURPOSE AND SCOPE OF THIS STUDY

An initial assessment of CRT program study requirements was made in May [5]. Attention was then addressed to tasks of more limited scope. As noted earlier, during the second half of FY 70 CNO (OP-56) was making plans for the use of leased, business jet aircraft in CRT flying at NALF Monterey. The leased jet aircraft would completely replace the T-1A aircraft then at NALF Monterey. The leased jet arrangement represented a departure from the traditional CRT program philosophy of using investment-free, ex-operational aircraft and was somewhat of an experiment.

A reasonable task then was to develop methodology and data by which the results of the experiment could be assessed.

On about 1 May, the authors began development of a study aimed toward making comparisons between the T-1A and leased jet as jet pilot proficiency aircraft. Because the leased jets were to begin flying on 1 July, 1970, any measurement of T-1A proficiency flying would have to be completed prior to that time. Time was a critical constraint.

A number of study procedures were devised; the nature of these procedures is discussed in the next section of this report. The study procedures developed were designed to be applicable to any aircraft or level of flying activity. The purpose of this report is to present the study procedures developed and report the data collected relative to jet aviator proficiency flying in T-1A aircraft at a rate of four hours per month.

II. THE STUDY

2.1 INTRODUCTION

Little time was available in which to develop the tools for evaluation. Supposition was that on 1 July the T-1A aircraft would be replaced by the leased jet and that the program would revert to flying 100 hours per year. It had to be assumed then that if data was to be gathered on the proficiency of aviators flying the T-1A at four hours per month, it would have to be completed on or before 1 July.

In evaluating the leased jet as a CRT aircraft, cost, scheduling, and maintainability data could be accumulated from existing reporting procedures. The more difficult aspects of evaluation include proficiency gained or maintained, and aviator satisfaction. It has earlier been mentioned that proficiency measurement is most difficult due to lack of definition, and that no methods are now available for determining absolute measures of proficiency.

It was recognized at an early stage that any measurements of proficiency and satisfaction that could be obtained would be only relative measures. The overall philosophy of the study effort became that of developing relative measures of proficiency, and then, by exercising control over conditions and aviators, applying the measures in June and again six months later. Any statistically significant differences in the measures would then be attributed to differences in aircraft and/or flight hours per month.

2.2 SOURCES OF DATA

It was determined that the following sources of data were available and that if data were collected from them it would be possible to determine if any significant differences were created by differences in aircraft flown or the hours per month flown.

a) The Pilots. This is the most logical point to begin measurement of flight proficiency and satisfaction. Experience data and measures of flight path vector control and instrument procedures appeared to be the most fruitful study areas.

b) NALF Monterey. The operations duty clerk, weather forecasters, GCA officer, and operations duty officer are all in a position to observe the behavior of CRT pilots and report various errors that could exhibit different characteristics coincident with changes in flight activity and/or aircraft. The schedules officer maintains records on the number of flights scheduled, flights cancelled, and the reasons for cancellations. If the level of flight activity or type of aircraft flown has any effect on the level of pilot motivation, it should be observable in the cancellations data. Another possible source of pilot proficiency measures is the maintenance office. It is known, for instance, that the rate of blown T-1A tires per landing has increased since the 48 hours per year schedule was implemented.

c) The FAA. The Monterey Tower approach control, departure control, and ground control, as well as Air Route Traffic Control Centers are all in a position to report minor infractions of aircraft handling and voice procedures that are not of such serious nature as to require formal disciplinary reporting, but which could be used to differentiate between flying activity levels.

d) Simulators and Operational Flight Trainers. Both devices have been shown to indicate the level of pilot proficiency.

e) Observers. An observer in a flight situation could provide valid information on the level of proficiency possessed by a pilot, given objective measures of proficiency and control of bias between observers.

f) Flight Recorders. Twenty-four channel data recorders have been used to measure flight path vector control parameters, and close adherence to established norms is an indication of the level of pilot proficiency.

Given the time constraint, the complete lack of research funds, and the reluctance or inability of some of the potential data sources to provide data to the study group, the only data sources actually employed were the pilots, NALF Monterey, and Flight Observers.

2.3 STUDY PROCEDURES

2.3.1 Introduction

The study procedures consisted of the measurement of a number of indicators of pilot knowledge, proficiency, and satisfaction. All

measurements are relative rather than absolute. A sample of jet aviators at NPS was created in such a way that all pilots studied in June and then transitioned to another aircraft or activity level could again be studied six months later.

The sample consisted of all aviators assigned as students to NPS who performed their CRT flying in the T-1A, and who were programmed to graduate in December 1970, or later. In an attempt to control, at least partially, the number of variables and to be able to attribute any observed differences to either aircraft type or activity level, the sample was further subdivided into five groups as follows:

a) Group One. Those jet pilots who arrived at NPS prior to December, 1969, and would graduate (leave CRT at NALF Monterey) in December, 1970;

b) Group Two. Those pilots who arrived in January, 1970, and who would graduate in December, 1970;

c) Group Three. Those pilots who arrived prior to December, 1969, and who would graduate in or after June, 1971;

d) Group Four. Those pilots who arrived on or after 1 January, 1970, and who would graduate in or after June, 1971.

e) Group Five. Those pilots selected randomly from Group Four to act as data recorders on the data flights, and who would remain at NPS during the entire test period.

The five groups included a total of 120 jet pilots, broken down by group as follows: Group One, 24 pilots; Group Two, 4 pilots; Group

Three, 32 pilots; Group Four, 35 pilots; and Group Five, 25 data recorders. All pilots were flying at a nominal rate of four hours per month, actually flown in three hour segments every three weeks. It is assumed that such possible relevant variables as age, initial proficiency, number of CRT tours, last flying duty, expected time and type of next flying tour, etc. are not correlated to either graduation date or first letter of last name and that, therefore, the assignment to one of these groups is random. However, biographical data of this type was captured and future analysis will be possible but will not be specifically addressed at this time. Forty-five percent of the sample pilots were Lieutenants or Captains, 39% were Lieutenant Commanders or Majors, and 16% were Commanders. Only 3 of the 120 pilots were Marines, all others were Navy. Total flight hours and total jet hours for the data pilots (groups one through four) were obtained from NPS Flight Office records. The data pilots had accumulated an average of 2420 hours and the range of hours was from 778 to just over 5300. The jet hours data was similar though with smaller magnitudes. They averaged 1850 jet hours with a range of from 241 hours to 4070 hours.

What follows are descriptions of the four types of knowledge, proficiency, and satisfaction data gathering devices employed.

2.3.2 The Questionnaire

All sample pilots were convened at the start of our data-gathering efforts. They were briefed on the purpose of the study, the extent of their participation, and the need for their cooperation. They were also told that in any measurement of their knowledge, proficiency,

or satisfaction, their ananymity would be preserved. Finally, they were cautioned against doing anything which would bias the data gathered.

After the briefing, all pilots were asked to complete a three page questionnaire which dealt with their qualifications and previous experience, and their assessment of the T-1A aircraft. Page two of the questionnaire sought structured assessments on a standardized form; page three provided an opportunity for the pilots to give unstructured, personal evaluations of the aircraft. The questionnaire, given in Appendix A, was administered to all groups of pilots.

2.3.3 The Instrument Exam

Following the completion of the questionnaire, pilots from groups one through four were given an unannounced, closed book instrument examination. The exam was the November, 1969, revision of the standard Commander Naval Air, Pacific instrument examination. Forty-five minutes were allowed for the exam. The purpose of the exam was to obtain a measure of pilot knowledge of instrument procedures. The examination is not given in an appendix of this report since it represents proprietary information.

2.3.4 NALF Monterey Operations Data

Data on flight operations at NALF Monterey were collected to provide information relative to pilot knowledge and motivation. The duty forecaster and the operations duty clerk were given forms on which to record errors made in the filing of DD-175 forms. The study forms, given in Appendix B, were to be completed for every T-1A flight flown in the period from 22 May, 1970, to 1 August, 1970. The GCA officer

was also provided with data forms, but the GCA unit was down throughout almost the entire study period due to antenna replacement.

The scheduling officer provided data on flights scheduled, flights actually flown, and information on cancellations. The cancellation data was to be used as a measure of pilot motivation. Once again, it is pointed out that all measurement of pilot knowledge, proficiency, or satisfaction were relative rather than absolute. The measurements become useful when compared to another set of measurements taken on the same aviator group but at a different flight activity level or in a different proficiency aircraft.

2.3.5 Data Flights

This report is about proficiency flying, and, while it is felt that all measurements described previously are related to proficiency flying, they were not direct measures of flying proficiency. Since direct measurement of flying skill was deemed imperative and since neither sophisticated simulators nor instrumented aircraft were available, the program of data flights with "back-seat" data recorders was conceived. A standardized 1.5 hour flight was developed. The pilot whose proficiency was being measured, the data pilot, commanded the aircraft and flew as though it were a solo flight. The data recorder in the back seat of the T-1A monitored the data pilot from preflight through shutdown.

More than 100 scores in sixteen categories were given to the data pilot by the data recorder in a data flight. The basis for these scores was a data flight book with sequentially arranged questions, criteria for awarding grades, and space to record the grade awarded. A

copy of the data flight book format is shown in Appendix C. The book itself was reduced to 5 x 8 inch size, printed on card stock, and spiral bound for the data recorder's kneeboard.

III. STUDY RESULTS

3.1 PREFACE

The study results are a compilation of the data obtained using the measures or measurement devices described in the previous section. The data are relative indicators of pilot knowledge, skill, and satisfaction. Few conclusions, if any, can be drawn from the data by itself. Since all measures employed are relative, conclusions can only be drawn between sets of similarly-obtained data. No appeal to absolute measures is possible.

3.2 THE QUESTIONNAIRE

3.2.1 Page One

The questionnaire is given in Appendix A. Page one of the questionnaire dealt with pilot experience data. The data are the sums of the responses made by each aviator without alteration. Each question is discussed in turn.

Question 3. This question categorizes aircraft presently being flown by the sample aviators, and includes aircraft being flown for proficiency at NALF Monterey. Also, the totals by category include multiple counts for those pilots flying both the T-1A and the US-2 at NALF Monterey, plus those flying at other air stations. One sample pilot is flying exclusively at another air station. The breakdown is as follows:

Aircraft Flown	Number of Pilots
T-1A	125
US-2	3
A4/TA4	3
T-28	1
Multiple	6

Question 4. NATOPS qualification in type of aircraft presently flying, includes all the aircraft being flown by aviators at NPGS and elsewhere as noted above.

NATOPS Qualified	96
Not NATOPS Qualified	31

Question 5. This question is a statement of individual qualifications as NATOPS evaluation or maintenance inspection pilot at NALF Monterey or elsewhere. It is noteworthy that the expected alternative qualification of assignment to the instrument flight check board was not included. A "Yes" response means that the particular aviator is qualified as either or both NATOPS or test pilot. "No" means not NATOPS, and not test pilot. The remaining responses are self explanatory.

Yes	- 18	
No	- 98	
Both	- 4	
NATOPS (only)	- 4	(A4)
Test (only)	- 1	
Inst (only)	- 1	

Question 6. The categories of type aircraft last flown by the aviator sample includes in several cases multiple types, and aggregates by basis model, e.g., A-4 includes TA4F, A4E, A4F, A4B, and A4C. Two responses not included in the category counts were responses as to the last time the individual had flown, chronologically, e.g., the previous day.

Aircraft Type	Number of Aviators
A4	46
A7	24
F4	24
F8	11
A6	9
T-28	5
RA-5	4
F9	4
T1	3
T2	3
A3	2
P3	2
T33	1
T39	1
TF10B	1
E2	1
P2	1
C45	1
C1	1
C131	1
R4D	1
C	117
US2	1
OV-10	1

Question 7. Estimated flying hours logged in year prior to NPGS, is organized so it may be used in a histogram with the intervals specified. The intervals themselves include the lower endpoint but do not include the upper endpoint. In three cases, the aviators responded by giving an estimate of their total flight hours accumulated before reporting to NPGS, from the time they first began flying. Those responses are not included in the tabulation. It should be emphasized that these are estimates and in all cases are round-offs to the nearest 5, 10, 50, or 100 hours.

Hours	Number of Aviators		
Less than 50	0		
50-100	2		
100-150	7		
150-200	12		
200-250	15		
250-300	27		
300-350	30		
350-400	15		
400-450	6		
450-500	3	Mean	300.4918
500-550	2		
550-600	1		
600-650	0		
650-700	0		
700-750	0		
750-800	0		
800-850	1		
850-900	0		
900-950	1		
950 and greater	0		

Question 8. This question asks if an aviator's last tour prior to NPGS was in a CRT billet. It needs no further explanation,

Yes - 6

No - 115

Question 9. If last tour was CRT, what was the tour duration in months? This question had the below listed responses, and, again, the interval endpoints are defined as in question 7:

Months	Number of Aviators
0-12	2
12-24	3
24-36	1

3.2.2 Page Two

Page two of the questionnaire asked for assessments of the present jet CRT aircraft. The actual responses are given in Table 1. The data gathered on the T-1A CRT characteristics, which were the opinions expressed by 120 aviators within the sample, indicated that the T-1A was considered an average to poor aircraft for CRT purposes. Although general T-1A procedures were considered to be average or above by 86% of the pilots sampled, their overall impressions of the safety of the aircraft indicates only 61% of them felt safe in the aircraft. The greatest dissatisfaction seemed to be with the short endurance characteristic of the T-1A (91%) and the comfort factor (73%).

TABLE 1. OPINIONS ABOUT T-1A CRT CHARACTERISTICS

	Great	Good	OK	Poor	Lousy	N/A
1. Procedures						
a. Preflight	3	48	60	7	2	0
b. Engine start	2	49	54	12	3	0
c. Emergency	1	36	59	18	6	0
d. Post flight	2	33	67	11	6	1
2. Handling						
a. Taxi	1	5	28	33	50	4
b. Take-off	3	26	72	15	4	0
c. Inst. Flt-Simulated/actual	6	39	37	27	10	0
d. Climb	0	23	62	28	7	0
e. Cruise	0	21	54	32	13	0
f. Descent	1	24	76	15	4	0
g. Approach	2	38	54	19	7	0
h. Landing	2	31	47	27	13	0
i. Slow flight	5	37	62	13	2	1
3. Safety						
a. Overall impression	0	24	49	33	10	0
b. Survival equipment	2	19	69	20	9	1
c. Escape systems	4	27	50	31	6	1
d. Stall warning	10	44	56	6	3	1
e. Stall/spin recovery	22	51	37	3	2	5
4. Navigation equipment	13	41	35	19	8	3
5. Endurance	0	0	10	37	72	1
6. Aerobatics	3	26	60	23	7	1
7. A/C flight limitations	2	15	57	27	8	1
8. Availability (maintenance)	0	13	40	53	14	0
9. Support away from home	1	9	35	31	34	10
10. A/C reliability	0	12	53	40	13	2
11. Comfort	0	2	28	39	49	2
12. Convenience	2	7	48	40	21	2
13. How good is the A/C as a CRT A/C?	0	16	43	46	15	0

3.2.3 Page Three

Page three of the questionnaire offered the sample aviators the opportunity to express opinions about the present jet CRT aircraft and program, without the highly structured format of page two of the questionnaire. Their responses, with and without attempts to summarize and categorize them, are now given.

The first half of page three, question II, responses were summarized in Table 2, followed by exaplanations of the categories used to classify the responses.

TABLE 2. SUBJECTIVE OPINIONS ABOUT T-1A

	Yes	Qualified Yes	No	Qualified No	No Comment
a. Confidence	54	38	7	25	8
b. Comfort	25	4	76	17	5
c. Fun to Fly	49	24	30	10	5
d. Maintains Skills	23	62	7	25	6

1. Yes and No. These categories include only the number of direct opinions recorded on the questionnaire, not carrying any modifying remarks, by each sub-category.

2. Qualified Yes. This category includes all favorable opinions by question, with modifying remarks as follows:

a. Confidence. Includes remarks about T-1A systems, engine power, aircraft age, maintenance quality, 4 hours per month flying time

restriction, aircraft endurance characteristics, IFR/VFR weather capabilities, ground training quality, and scheduling policies.

b. Comfort. Includes remarks about cockpit elbow room, the Martin-Baker Seat particularly and in general, leg room in both cockpits, comparisons between cockpits, ability to reposition rudder pedals, seat height relations to pilot's head height, and comparisons with the A4.

c. Fun to fly had specific remarks about poor endurance, poor performance capabilities, 4 hours per month limitations, time between flights being excessive, acrobatics capability of T-1A, and loss of familiarity with aircraft.

d. Maintains skills question had remarks about IFR versus VFR flying, acrobatic capability, T-1A good for instruments but nothing else, skills retained were not operational type skills, skills slowly eroding, not safe, aircraft systems considerations, the 4 hours per month restriction versus 8 or 12 hours per month, and the T-1A landing characteristics.

3. Qualified No is defined as the qualified Yes, and included:

a. Confidence. Remarks about aircraft age, systems, maintenance, ground training, checkouts, scheduling policies, and the 4 hours per month restriction.

b. Comfort included marginal leg and head room of cockpit, and other items considered unsafe.

c. Fun to fly had remarks about aircraft endurance, poor aircraft performance, satisfies urge to fly, acrobatic capability, 4 hours per month restriction.

d. Maintains skills had many remarks such as 4 hours per month restriction, aircraft capabilities and performance not a challenge, comparisons to operational fleet aircraft and operational missions, and skills retained not being the necessary operational skills.

4. No comment was the number of the various questions left blank or marked as not considered applicable.

5. It should be noted that the above data was collected as specific remarks about the particular subject only. As would be expected, more than several aviators presented more than one idea on each subject. Summing the figures in Table 2 will not yield the number of aviators questioned.

The second half of page three, question III, yielded a number of interesting comments. The following is a compilation of the salient topics and ideas given by this group of aviators when asked to comment. The subject is listed, followed by a resumé of opinions. The number following each subject title signifies the number of aviators presenting ideas about that subject. A total of 125 different opinions were recorded from 56 of the 120 pilots polled. No comments were received from the remaining 64 pilots.

1. The CRT Aircraft (23)
   - Aviators should be assigned to fly a CRT aircraft according to their previous experience. (1)
   - A CRT aircraft requires an acrobatic capability to retain operational skills especially for fighter/attack pilots. (8)
   - T-1A is poor due to performance capabilities. (9)
   - Enjoy the T-1A but would switch to S-2 in preference to a civil jet. (1)

- T-1A preferable to civil jet (1), perfectly adequate. (1)
- T-28 or T-2 preferable to T-1A. (1)
- The T-1A is similar to all fleet aircraft in that it has an ejection seat, a bubble canopy, throttle and engine controls on the left, stick versus yoke, and acrobatic capability. (1)

1. CRT Generally (19)
   - CRT is a misnomer. (3)
   - 4 flight hours a month insufficient. (1)
   - 4 flight hours a month hazardous. (1)
   - 4 to 8 flight hours per month will not guarantee anyone's skill, but will keep from completely losing that skill and will make the return to operational flying less traumatic. (1)
   - Since anyone returning to the fleet receives CRAW/RAG training, why not admit that CRT is worthless? (1)
   - Flying 24 hours a fiscal half year makes it hard to do anything but work hard to stay qualified (in type). (1)
   - CRT flying "worthless" for aviators in "student" billets. (1)
   - CRT flying in poor shape due to people who manage it. (1)
   - (I have) Some fear plus apprehension as to being able to hack it in the fleet; hack going aboard ship; can I keep up with the first tour types? With more realistic proficiency flying, I would not have though twice about returning to the fleet. (2)
   - It is doubtful that fun is the object of flying this type of machine or doing this type of flying. A waste of time. (1)
   - CRT in itself is ridiculous. Flying a "lesser aircraft" doesnot keep you proficient in anything [presumably mission

proficiency] that is necessary. CRAW/RAG's should be able to provide information as to effectiveness of CRT. (1)

- At 4 hours per month, it takes the whole first half of a hop to be sure of what I am doing. (1)
- Consider general airmanship most important as part of CRT. (1)
- No reduction in skill or confidence felt when reduced from 8 to 4 hours per month. (1)
- Number of flights per unit of time period would be better measure of proficiency than flight hours. (1)
- Consider some training accomplished just by strapping into the aircraft. (1)

3. Scheduling and Airbase Facilities (20)

- As a [NATOPS, Instrument] check pilot, I never get to fly, just sit in back and watch. (1)
- No transition syllabus into the T-1A. (1)
- No hood for simulated instruments. (1)
- Need abort gear at NALF Monterey. (1)
- I have been scratched or aborted an excessive number of times. (1)
- Need NAMO, emergency procedures ground trainer, periodically administered emergency procedures examination, and a cockpit checkout before first hop. (1)
- Cannot understand why [purpose] "A" time should count against "B" time maximum total flight hours. (1)
- Want more variation in type of hops flown. (3)
- Want more/unlimited cross countries. (1)

- Want briefed multiple aircraft flights scheduled. (6)
- Want 8 to 10 flight hours per month. (1)
- Want better maintenance including preflights. (2)
- Runways and facilities at Monterey are marginally safe in bad weather. (2)

3.3 THE INSTRUMENT EXAMINATION

The unannounced, closed-book, COMNAVAIRPAC instrument exam was administered to all data pilots in sample groups one through four. The data recorders, group five, did not take the exam. A total of 96 data pilots took the exam: one of these was subsequently dropped from the sample. The exam was graded in such a way that the maximum score was 54 points.

The average score attained by the data pilots was 33.3, with a standard deviation of 6.8 points. The breakdown of scores by interval was:

Total Score	Number
0 - 14.5	0
15 - 19.5	1
20 - 24.5	8
25 - 29.5	20
30 - 34.5	31
35 - 39.5	21
40 - 44.5	9
45 - 49.5	6
50+	0

The exam scores indicated that 18% of the pilots tested answered less than half of the questions correctly and that the average percentage of correct answers was 67% (33.3/54). These scores, by themselves, are not necessarily meaningful. They are scheduled to be used with the scores obtained by pilots taking the November 1970 edition of the COMNAVAIRPAC instrument exam. The new exam will be administered toward the end of this calendar year to members of groups one through four who since 1 July have been flying at a nominal rate of eight hours per month.

3.4 NALF MONTEREY OPERATIONS DATA

3.4.1 Schedules Data

Operations data from NALF Monterey was collected during the period from 22 May 1970 to 31 July 1970 on every T-1A flight. During the period, a total of 412 sorties were scheduled and a total of 369 sorties were actually flown. There were an even 100 cancellations for various reasons, not all of which necessarily cancelled the sortie. Full data is shown in Table 3.

A part of the cancellations data reflects pilot motivation. Though not quantified, it is known that pilots are now cancelling for weather reasons when they would have flown in the same weather when they were on a 100 hours per year level. An interesting point on cancellations for academic reasons was found in [12]. The Barton, et. al., study group found that only 30% of the aviators in their first CRT tour had ever cancelled a flight due to study work load or other academic considerations, while 67% of the aviators with prior CRT tours had found it necessary to do so. It is speculated that motivation to

TABLE 3

NALF MONTEREY T-1A SCHEDULES DATA: 22 May - 31 July 1970

SORTIES SCHEDULED		412
Scheduled Sorties Flown	323	
Non-Scheduled Sorties Flown		
Maintenance	17	
Purpose B	21	
Other		
TOTAL SORTIES FLOWN		369
CANCELLATIONS		
Weather	22	
Scheduling Error	17	
A/C Went Down	15	
Academic	14	
Pilot(s) Sick	13	
Pilot(s) No-Show	7	
Pilot Request (Other than Academic)	6	
Other	6	
TOTAL CANCELLATIONS		100

participate in CRT flying, rather than academic pressures, is the real reason behind "academic" cancellations.

3.4.2 Duty Forecaster Data

On every T-1A flight during the 22 May - 31 July 1970 period, the duty forecaster maintained a record of DD-175 and/or weather briefing deficiencies. This data shows that problems were encountered with 8% of the DD-175's and/or briefings. Table 4 gives a breakdown of this data.

TABLE 4. CRT STUDY: DUTY FORECASTER TALLY

TOTAL FLIGHTS FLOWN		369
Information on DD-175 Incomplete	20	
Alternate Requirements Not Understood	4	
Inattention to Brief or Did Not Understand	1	
Other	5	
TOTAL PROBLEMS		30

3.4.3 Operations Duty Desk Data

Again, all T-1A flight DD-175 forms were monitored for problems of various types. The "problem rate" at the operations duty desk was 43%, as detailed in Table 5.

TABLE 5. CRT STUDY: OPS DUTY DESK CLERK

TOTAL FLIGHTS FLOWN		369
Incorrect DD-175	58	
Incomplete DD-175	71	
Misunderstanding over IFR/VFR	2	
Needed help	14	
Other	15	
TOTAL PROBLEMS		160

3.5 DATA FLIGHTS

The data flights were begun at NALF Monterey on 8 June 1970, and completed on 21 August 1970. Early problems included the three-week voluntary sign-up schedule in effect at the end of the NPS academic year, and, after 1 July, scheduling difficulties. The scheduling problems were satisfactorily resolved ultimately.

The data recorders, group five, were assigned from two to six data flights and CRT maximum hour limits were waived where necessary. All data recorders were briefed on the purpose of the flights, and the data flight book, page by page. Further, they were asked not to show the data flight book to the data pilot and not to discuss the results with him. The data flight book is shown in Appendix C.

Differences between data recorders exist, as well as differences in how a given data recorder interprets the grading criteria from flight to flight. The data flight scores awarded were relative scores. In an attempt to minimize the subjective aspects of data pilot evaluation,

the study was designed so that the next series of data flights will be conducted utilizing the same data pilots and the same data recorders. For completeness, it is recorded that some problems were encountered in the program of data flights, that the problems involved both data pilots and data recorders, and that the problems disappeared when positive leadership was provided by NALF Monterey Operations.

The complete results of the 96 data flights are given in Appendix D; there were 96 data flights but one of the data pilots was later dropped from the sample. The data was first summarized in terms of the scores achieved in each of the 16 flight phases, from preflight to shutdown. That data was then aggregared into six categories as follows:

Category	Question
1. Preflight	1,2
2. Fundamentals	3,4,14,15
3. Climbs	5,9
4. Enroute	6,10
5. Letdowns	7,8,11,12,13
6. Other	16

Computation of average scores, etc., is difficult since the maximum possible score could differ from flight to flight. Examples were that the entry for landing in Monterey could have been under VFR conditions (question 12) or IFR conditions (question 13) but usually not both although some data recorders requested the data pilot to do both when

possible. A further example is that several data flights were completed with a hot refueling cycle and therefore shutdown (question 15) was not applicable.

As this set of data flights are to be compared to a set of data flights later this year, and since this data cannot "stand by itself", little analysis of the data was done at this time. The maximum possible score was 97 points. The range of data flight raw scores obtained was from -38 to +91. The average raw score was 32.8 points, in spite of the fact that the scoring criteria were designed in such a way that the average aviator should, theoretically, have received a zero score.

In aggregating the scores into six categories, average scores were computed taking into account the maximum score possible for each individual data flight. The maximum possible score varied from flight to flight as explained above. In computing average scores by category, the total points achieved were divided by the maximum possible, flight by flight. The results were as follows:

Category	Average Score
1. Preflight	.438
2. Fundamentals	.468
3. Climbs	.177
4. Enroute	.384
5. Letdowns	.422
6. Other	.477

The testing of the proficiency pilots was conducted within the proficiency flying context. That is, the data flights did not involve tactics, high-g maneuvers, or carrier landings. Further, the data flight data does not provide absolute measures of proficiency. Even so, it is interesting to note the relative proficiencies as indicated by the categorized data flight average scores. Climbs, enroute segments, and letdown are performed with relatively less proficiency than, for example, fundamentals.

From data flights to be conducted later this year, after the sample data pilots have flown at the four hour per month rate for a longer time (one year), it should be possible to indicate the types of skill deterioration caused by the four hour per month schedule, if, in fact, there are any.

IV. SUMMARY AND CONCLUSION

This report has been addressed to the study of proficiency flying within the Navy, and specifically, to the task of developing methods whereby changes in the CRT program (aircraft, or hours flown primarily) can be evaluated with respect to aviator knowledge, skill, or satisfaction.

Measures or measurement techniques have been developed and applied to a sample of 96 jet aviators in the NPS/NALF Monterey community. In proficiency, definition, let alone measurement, is difficult. None of the data taken represents measures from an absolute scale. The data described in the previous section is useful only when compared to data obtained in a similar manner with a modified CRT program structure.

As indicated in the introduction, the study was conceived in the context of evaluating the anticipated change from T-1A leased jet aircraft. The 1 July 1970 change-over to leased jets did not take place. In its place, NALF Monterey has received authorization to schedule 40 aviators, from groups one through four, for 100 hours per year for FY 71. In December 1970, the "100 hour group" will again be subjected to the questionnaire, the instrument exam, NALF Monterey Operations scrutiny of their DD-175's, and the data flights. When this analysis is completed, it should be possible to make statements relative to the knowledge, skill, and satisfaction of jet CRT aviators flying 100 hours per year as compared to those aviators flying 48 hours per year.

It is further anticipated that the Aviation Training Division (OP-56) will follow the 40 "100 hour aviators" in their subsequent CRAW/RAG

billets in an attempt to determine whether the CRT flying rate has an influence on retraining requirements, costs, or time.

APPENDIX A

SAMPLE PILOT QUESTIONNAIRE

Pilot Questionnaire

CRT STUDY

1. File Number _____

2. Graduation date (month, year)? _____

3. What A/C are you presently flying? _____

4. Are you NATOPS qualified in this A/C? _____

5. Are you a NATOPS check pilot and/or a maintenance test pilot? _____

6. Type A/C last flown? _____

7. Estimated pilot hours logged in year prior to NPS _____

8. Was last assignment prior to NPS in CRT flying (yes, no)? _____

9. If question (8) affirmative, how long was the CRT tour (months)? _____

I. T-1A CRT CHARACTERISTICS:

Please indicate your opinion of the T-1A as a CRT A/C:

	Great	Good	OK	Poor	Lousy	N/A
1. Procedures						
a. Preflight						
b. Engine start						
c. Emergency						
d. Post flight						
2. Handling						
a. Taxi						
b. Take-off						
c. Instrument Flight Simulated/Actual						
d. Climb						
e. Cruise						
f. Descent						
g. Approach						
h. Landing						
i. Slow flight						
3. Safety						
a. Overall impression						
b. Survival equipment						
c. Escape systems						
d. Stall warning						
e. Stall/spin recovery						
4. Navigation equipment						
5. Endurance						
6. Aerobatics						
7. A/C flight limitations						
8. Availability (maintenance)						
9. Support away from home						
10. A/C reliability						
11. Comfort						
12. Convenience						
13. How good is the A/C as a CRT A/C?						

II. Please indicate your personal, subjective feelings about the T-1A with regard to:

1. Confidence_____

_____.

2. Comfort_____

_____.

3. Fun to fly_____

_____.

4. How well does flying the T-1A maintain your flying skills____

_____

_____.

III. Additional Comments - if you care to_____

_____

_____

_____.

APPENDIX B

NALF MONTEREY OPERATIONS

DATA COLLECTION FORMS

NALF SCHEDULES DATA LIST

CRT STUDY

*Daily Summary

_____
Date

	T-1A	Leased Jet
Sorties Scheduled	_____	_____
Scheduled Sorties Flown	_____	_____
Non-scheduled Sorties:		
Maintenance	_____	_____
Purpose B	_____	_____
Other	_____	_____
Cancellations:		
Academic	_____	_____
Pilot(s) sick	_____	_____
A/C went down	_____	_____
Non-availability of A/C	_____	_____
Pilot(s) no show	_____	_____
Other (specify)	_____	_____
_____	_____	_____
_____	_____	_____
Total	_____	_____

DUTY FORECASTER

CRT STUDY

Please fill out the following information for every T-1 or leased jet DD-175 filed during your watch. Turn in all completed forms to the ODO.

Pilot's file no.	Copilot's file no.	Date

Information on DD-175 incomplete	_____	Inattention to brief or did not understand	_____
Alternate requirements not understood	_____	Other (specify)	_____

OPS DUTY DESK CLERK

CRT STUDY

Please fill out the following information for every T-1 or leased jet DD-175 filed during your watch. Turn in all completed forms to the ODO.

Pilot's file no.	Copilot's file no.	Date

Incorrect DD-175	_____	Needed help	_____
Incomplete DD-175	_____	Other(specify)	_____
Misunderstanding over IFR/VFR	_____	None	_____

MONTEREY GCA

CRT STUDY

This is a request for data for a study of T-1A and leased jet pilot proficiency. An entry on this form does not put pilot on report. Please record and briefly but specifically describe each occurrence by a T-1 or leased jet crew of glitches; i.e., procedural error, violations of SOP or local regulations, poor voice procedures, confusion, interference with traffic, etc., as you may feel appropriate.

T-1A and LEASED JET

CALL SIGN	TIME	DATE	GLITCH

APPENDIX C

DATA FLIGHT BOOK

CRT STUDY DATA FLIGHT

Data Pilot file no. _____

Data Recorder file no. _____

Bu No _____

Date _____

DATA FLIGHT SPECIFICATIONS

1.5 hours first pilot time for data pilot

IFR to other than home field (enter PCA if feasible)

Penetration/GCA/missed approach at IFR intermediate destination (Lemoore)

Return to Monterey (VFR if VMC) (or other destination)

INSTRUCTIONS TO DATA RECORDER

Circle appropriate score. If not applicable, circle zero. Add remarks if desired. Do not brief or debrief data. Do not discuss or show forms to data pilot.

1. PLANNING AND FILING

a. DD-175:

Completed correctly without reference to FLIP	+1
Correct with reference to FLIP	0
Incorrect upon submission to ODO	-1

b. Weather:

Understood, asked pertinent questions, checked charts	+1
Passive, but understood	0
Failed to understand, missed significant item, or didn't know alternate requirements	-1

c. Planning Parameters:

Used flip lists and correct TAS, IAS and fuel flow, range and time to climb	+1
Used accurate estimates for above	0
Guessed or failed to plan above	-1

d. Familiarity with Publications (FLIP, Enroute, Supplements, Terminal pubs and NATOPS check list):

Knew where to find and how to use desired information	+1
Knew what he wanted but not where to find it	0
Failed to use or misinterpreted pubs	-1

2. PREFLIGHT

a. Knowledge of Inspection Points:

Complete knowledge of points and tolerances	+1
Overlooked one major point	0
Incomplete knowledge, overlooked more than one	-1

b. Thorough or Cursory Inspection:

Thorough, concentrated	+1
Minimal	0
Cursory or lackadaisical	-1

c. Ejection Seat/Pins:

Knew all points and tolerances; thorough inspection	+1
Satisfactory, minimal effort	0
Marginal, would have missed on unsafe situation	-1

d. Use of checklist:

Did, thoroughly and correctly	+1
Didn't (didn't need it)	0
Didn't use it (should have)	-1

3. START AND TAXI

a. Use of Checklist:

Did, thoroughly and correctly	+1
Didn't (didn't need it)	0
Didn't use it (should have)	-1

b. Malfunction Procedures (if applicable):

Malfunction occurred, handled properly	+1
No malfunction	0
Goofed	-1

c. Post-start Checks and Signals:

Known, understood, done properly	+1
Minor, but no unsafe, errors	0
Not known or not understood or improper	-1

d. Taxi Voice Procedures:

Proper radiotelephone procedures	+1
Satisfactory, but minor errors	0
Arrogant, abusive, intolerant, or major error	-1

e. Taxiing Technique:

Proper power, speed, steering and configuration	+1
Satisfactory, but rough	0
Imprudent or improper technique	-1

f. Systems Checkouts:

Correct and thorough pretakeoff checks	+1
Some uncertainty, but safe	0
Incomplete or incorrect	-1

g. Instrument Clearance:

Clear, concise, correct readback	+1
Minor problem, but correct	0
More than one misunderstanding, or sloppy	-1

4. TAKEOFF

a. Runup and Final Checks:

All systems on, checks quick, sure and complete	+1
Checked most systems, monitored engine performance	0
Forgot more than one system or rolled with major discrepancy	-1

b. Takeoff Directional Control:

Smooth, no significant deviations from centerline	+1
Minor deviations, reasonable corrections	0
Swerved, rough	-1

c. Liftoff and Cleanup:

Rotated at proper speed, smooth, correct pitch	+1
Minor deviations, observed airspeed restrictions	0
Rough, cleaned up too early or too late	-1

d. Heading and Attitude Control:

Smooth and sure (+ 3 degrees)	+1
OK (3-8 degrees)	0
Rough, large deviations	-1

5. CLIMBOUT AND DEPARTURE

a. Climb Schedule:

± 10 KIAS, smooth	+1
± 15 KIAS	0
> 15 more than once, or rough	-1

b. Adherence to Departure Clearance:
(indicate which SID used) Bay One [ ] Cannery One [ ]

No errors (± 5 degrees),(± 100 ft.)	+1
Minor errors (5-10 degrees),(± 200 ft.)	0
Major error(s) (busted clearance, missed check point)	-1

c. Climb Safety Checks:

Done, correctly, timely	+1
Done, perfunctorily	0
Missed or mistaken	-1

d. Navaid Usage:

Checked ID, correct selection, IFF	+1
Minor errors, but made proper path	0
No ID check, selectors wrong, missed freq. change	-1

e. Radial Course Control During Transition Climb:

± 2 degrees	+1
± 2-5 degrees	0
± > 5 degrees	-1

f. Arrival at Assigned Altitude/FL:

± 100 ft. and smooth	+1
100-200 ft.	0
± > 200 ft. or rough	-1

g. Voice Radio Procedures:

Clear, concise, timely, sharp	+1
Proper	0
Confused, incorrect or untimely	-1

6. ENROUTE

a. Clearance Adherence:

Did	+1
Minor errors	0
Didn't	-1

b. Course Control:

+ 2 degrees average, not more than 5 degrees	+1
Never more than 10 degrees off	0
> 10 degrees	-1

c. Altitude Control:

Generally ± 50 ft., occasional ± 100 ft.	+1
± 100 ft., never more than 200 ft. off	0
+ > 200 ft.	-1

d. Basic Airwork:

Very smooth, always in control	+1
Generally smooth	0
Improper corrections, rough, or both	-1

e. Headwork and Anticipation:

Always thinking, checking, planning ahead	+1
Occasional lapses	0
Generally behind	-1

f. Navigation and Navaid Usage:

Proper switchover points, crosschecks, ID	+1
Conformed to clearance/airway, minor errors	0
Drifted off airway, skipped ID, etc.	-1

g. Fuel/Oxygen Systems Monitor/Management:

Did, properly and continually	+1
Minor lapses, intermittent	0
Inattention or worse	-1

h. Lookout Doctrine:

Head up and out, systematic search	+1
Looked out sometimes	0
Head in cockpit	-1

i. Ask the pilot, "If you had a major malfunction right now, what would you do and where would you go?"

Immediate, adequate and appropriate response	+1
Had a good idea what and where within 10 seconds	0
Inadequate and/or indecisive	-1

7. ARRIVAL AND PENETRATION

a. Headwork and Anticipation, Descent Checklist:

Had previewed, fuel/weather checks, planned descent	+1
Responded properly, but not well ahead, and not behind	0
No anticipation, got behind	-1

b. Basic Airwork:

Very smooth, always in control	+1
Generally smooth	0
Improper corrections, rough, or both	-1

c. Radial/Arc Course Control:

± 2 degrees and ± 1 mile, occasional deviation	+1
+ 2-5 degrees and ± 1-2 miles, occasional deviations	0
Frequent > ± 5 degrees and/or > 2 miles	-1

d. Arrival at Assigned Altitude:

± 100 ft. and smooth	+1
100-200 ft.	0
+ 200 ft. or rough	-1

e. Voice Radio Procedures:

Clear, concise, timely, sharp	+1
Proper	0
Confused, incorrect or untimely	-1

f. Basic Airwork:

Very smooth, always in control	+1
Generally smooth	0
Improper corrections, rough, or both	-1

g. Clearance Adherence:

Did	+1
Minor errors	0
Didn't	-1

h. Configuration Changes:

Smooth, proper airspeed, small heading and altitude deviations	+1
Proper, but ± 5 degrees and ± 50 feet deviations	0
Rough, busted airspeed, late	-1

8. FINAL APPROACH (GCA)

a. Power:

Smooth, small, anticipatory corrections	+1
Occasional major throttle adjustments required	0
Rough, gross throttle adjustments	-1

b. Attitude/Angle of Attack:

Smooth, on speed, checked weight vs airspeed/angle of attack	+1
Proper, occasionally fast or slow	0
Rough, consistently fast or slow	-1

c. Heading:

± 2 degrees	+1
± 2-5 degrees	0
± > 5 degrees	-1

d. Glide Path Control:

Smooth and on or consistently "slightly above/below"	+1
Occasionally "above" or "below," not rough	0
Rough or erratic or frequently "above" or "below"	-1

e. Altitude:

Made minimums smoothly within ± 50 ft.	+1
Rough, or more than 50 ft. above minimums	0
Busted	-1

f. Missed Approach:

Smooth, proper, timely	+1
Proper, minor pitch/bank deviations	0
Rough, overbanked, late, overcontrolled	-1

9. CLIMBOUT AND DEPARTURE

a. Climb Schedule:

+ 10 KIAS, smooth	+1
± 15 KIAS	0
± 15 more than once, or rough	-1

b. Adherence to Departure Clearance:

No errors (+ 5 degrees), (± 100 feet)	+1
Minor errors (5-10 degrees), (± 200 feet)	0
Major error(s) (busted clearance, missed check point)	-1

c. Climb Safety Checks:

Done, correctly, timely	+1
Done, perfunctorily	0
Missed or mistaken	-1

d. Navaid Usage:

Checked ID, correct selection, IFF	+1
Minor errors, but made proper path	0
No ID check, selectors wrong, missed freq. change	-1

e. Radial Course Control During Transition Climb:

± 2 degrees	+1
± 2-5 degrees	0
± > 5 degrees	-1

f. Arrival at Assigned Altitude/Fl:

± 100 ft. and smooth	+1
100-200 ft.	0
± > 200 ft. or rough	-1

g. Voice Radio Procedures:

Clear, concise, timely, sharp	+1
Proper	0
Confused, incorrect or untimely	-1

10. RETURN TO MONTEREY (check one) IFR [ ] VFR [ ]

a. Weather Check:

Did, received and interpreted correctly	+1
Minor error, or relied on previous forecast	0
Failed to consider	-1

b. IFR Cancellation:

Proper voice procedure, IFF, VFR altitude	+1
Minor errors, or not applicable	0
Uncertain, improper procedure	-1

c. Navigation:

Certain, smooth, correct	+1
Wandered somewhat, but proceeded purposefully	0
Aimless, confused, violated restricted area, etc.	-1

d. Cruise Control:

Altitude, airspeed, fuel and oxygen OK	+1
Minor inattention or minor error	0
Wasted fuel or O_2, wrong altitude, behind	-1

e. Basic Airwork:

Very smooth and positive attitude control	+1
Reasonably smooth, maintained adequate control	0
Rough, erratic, uncoordinated movements or behind	-1

11. ENTRY IFR (check if applicable) [ ]

a. Headwork and Anticipation, Descent Checklist:

Had previewed, fuel/weather checks, planned descent	+1
Responded properly, but not well ahead, and not behind	0
No anticipation, got behind	-1

b. Basic Airwork:

Very smooth, always in control	+1
Generally smooth	0
Improper corrections, rough, or both	-1

c. Radial/Arc Course Control:

$\pm$ 2 degrees and $\pm$ 1 mile, occasional deviation	+1
$\pm$ 2-5 degrees and $\pm$ 1-2 miles, occasional deviations	0
Frequent > $\pm$ 5 degrees and/or > 2 miles	-1

d. Arrival at Assigned Altitude:

$\pm$ 100 ft. and smooth	+1
100-200 ft.	0
$\pm$ > 200 ft. or rough	-1

e. Voice Radio Procedures:

Clear, concise, timely, sharp	+1
Proper	0
Confused, incorrect or untimely	-1

f. Basic Airwork:

Very smooth, always in control	+1
Generally smooth	0
Improper corrections, rough, or both	-1

g. Clearance Adherence:

Did	+1
Minor errors	0
Didn't	-1

h. Configuration Changes:

Smooth, proper airspeed, small heading and altitude deviations	+1
Proper, but $\pm$ 5 degrees and $\pm$ 50 feet deviations	0
Rough, busted airspeed, late	-1

12 ENTRY VFR (check if applicable) ☐

a. Check Points/Altitudes/Airspeeds:

Knew and complied with course rules, on speeds and altitude	+1
No violations	0
Didn't know, or missed, points, altitudes and/or speeds	-1

b. Voice Procedures:

Clear, concise, correct	+1
Adequate	0
Arrogant, abusive, or interfered with traffic	-1

c. Headwork:

Had previewed, fuel/weather checks, planned descent	+1
Responded properly, but not well ahead, and not behind	0
No anticipation, got behind	-1

d. Lookout Doctrine:

Head up and out, respected traffic constraints	+1
Adequate, no interference with traffic	0
Didn't look, or interfered	-1

e. Adherence to Clearances:

Did, in a positive manner, with foresight	+1
Did, perfunctorily	0
Did not comply with (a) clearance(s)	-1

13. IFR APPROACH

a. Power:

Smooth, small, anticipatory corrections	+1
Occasional major throttle adjustments required	0
Rough, gross throttle adjustments	-1

b. Attitude/Angle of Attack:

Smooth, on speed, checked weight vs airspeed/angle of attack	+1
Proper, occasionally fast or slow	0
Rough, consistently fast or slow	-1

c. Heading:

± 2 degrees	+1
± 2-5 degrees	0
± > 5 degrees	-1

d. Glide Path Control:

Smooth and on or consistently "slightly above/below"	+1
Occasionally "above" or "below," not rough	0
Rough or erratic or frequently "above" or "below"	-1

e. Altitude:

Made minimums smoothly within ± 50 feet	+1
Rough, or more than 50 feet above minimums	0
Busted	-1

f. Missed Approach:

Smooth, proper, timely	+1
Proper, minor pitch/bank deviations	0
Rough, overbanked, late, overcontrolled	-1

14. FULL STOP LANDING

a. Airspeed, Angle of Attack, Use of All-Attitude-Indicator:

Smooth, on speed, checked weight vs airspeed/angle of attack	+1
Proper, occasionally fast or slow	0
Rough, consistently fast or slow	-1

b. Power Control:

Smooth, small, anticipatory corrections	+1
Occasional major throttle adjustments required	0
Rough, gross throttle adjustments	-1

c. Basic Airwork:

Very smooth, always in control	+1
Generally smooth	0
Improper corrections, rough, or both	-1

d. Checklist:

Knew where to find and how to use desired information	+1
Knew what he wanted but not where to find it	0
Failed to use or misinterpreted pubs	-1

e. Touchdown Technique:

Proper, smooth, level bank, on speed (or nice flare)	+1
Respectable, ± 5 KIAS	0
Rough, erratic, 10 or more KIAS fast, or landed long	-1

f. Rollout Heading/Altitude Control:

Smooth, proper use of rudder, brakes, steering and aerodynamic braking	+1
Adequate and safe, but not impressive, no damaged tire, no hot brakes, didn't oversteer	0
Excessive braking, steering or swerve, or no aerodynamic braking	-1

g. Headwork (Data Recorder's judgment, examples given):

Used good sense and judgment (waved off bad approach)	+1
OK	0
Misjudged, too aggressive, or too complacent (tried to salvage bad approach)	-1

h. Turnoff/Taxi Technique:

Smooth, properly slow, correct configuration	+1
Rough but adequate, complied with procedures	0
Fast, improper configuration, improper power/brake	-1

i. Voice Procedures:

Timely switch, proper calls, complied with clearance, did not interfere with tower/ground control	+1
Adequate	0
Late or didn't switch, poor procedure, or interfered	-1

15. SHUTDOWN

a. Parking:

Proper brake/power usage, cooperated with director	+1
Some power/brake problems, but adequate	0
Rough, fast, uncooperative, misjudged turn	-1

b. Systems Shutdown/Checklist:

Used checklist, proper procedure, orderly, complete	+1
Complete but random	0
Incomplete or misused	-1

c. Engine Shutdown:

Timely compliance, anticipated blowout (T-1)	+1
Delayed, but proper compliance	0
Late, non-compliance, or indecision	-1

d. Cockpit Cleanup (check pilot inspect):

Thorough and adequate	+1
Missed one or two minor switches	0
Major, or more than two switches wrong	-1

e. Postflight Inspection:

Did, thoroughly	+1
Perfunctory	0
Didn't, or missed discrepancy	-1

16. GENERAL CATEGORIES

a. Yellow Sheet:

Correct, brief, legible	+1
Adequate, needed help	0
Error, omission, illegible or sloppy	-1

b. Handling of Emergencies/Malfunctions (if applicable):

Did, proper procedures, good judgment	+1
Slow reaction, but correct; or not applicable	0
Error, indecisive, lack of knowledge	-1

c. Pilot's Personal Equipment:

All on, clean, and in good shape	+1
Complete, but not smart	0
Gear missing or very dirty	-1

d. Airplane Condition (no grade, check box)

Outstanding	☐
Average and adequate	☐
Airplane condition was such that it might bias pilot's score	☐

APPENDIX D

DATA FLIGHT SUMMARY DATA

AVIATOR FLIGHT EVALUATION DATA FLIGHT PHASE SCORES

#	Phases 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total (+)	Total (-)	Total Net	Average
2	1	1	2	1	-1	3	-2	2	-1	1	-1	1	0	5	2	2	21	-5	16	1.00
3	2	1	3	-1	-2	2	0	2	0	0	7	0	2	1	0	2	22	-3	19	1.19
4	0	0	-2	1	3	1	1	0	-2	3	3	0	0	1	1	2	16	-4	12	0.75
5	2	1	3	2	5	8	2	-	3	1	-	1	-	4	2	1	35	--	35	2.70
6	0	4	-1	2	1	5	2	6	0	1	0	-	1	8	0	3	33	-1	32	2.13
7	4	4	6	4	7	9	8	6	7	5	8	-	6	9	5	3	91	--	91	6.07
8	3	3	5	2	0	3	0	2	1	1	-	4	-	4	3	1	32	--	32	2.29
9	2	1	2	3	1	1	0	3	0	1	-	0	-	3	1	3	21	--	21	1.50
10	3	4	6	4	2	5	7	4	4	1	-	4	-	7	3	3	57	--	57	4.07
11	0	4	4	4	6	6	8	5	5	2	8	-	5	7	2	2	68	--	68	4.57
12	1	2	5	3	0	2	1	3	3	0	-	1	3	6	1	2	33	--	33	2.20
13	-1	2	4	0	-2	0	-	5	3	1	-	3	-	4	1	-1	23	-4	19	1.46
14	-2	0	4	2	0	4	2	3	0	0	-	4	-	5	3	2	29	-2	27	1.93
15	2	2	5	3	3	5	7	6	1	4	-	5	-	7	3	2	55	--	55	3.93
16	3	4	5	4	4	6	5	1	7	4	4	-	-2	-1	2	1	50	-3	47	3.13
17	3	3	4	4	4	6	1	4	2	2	-	-1	-	0	2	2	37	-1	36	2.67
18	1	3	4	0	1	1	2	1	1	1	2	-	3	8	2	1	31	--	31	2.06
19	1	3	1	1	0	3	2	0	0	2	-	1	0	3	2	2	21	--	21	1.50
20	3	3	5	2	1	2	1	0	0	4	-	5	-	1	3	1	31	-	31	2.21
21	0	3	2	3	0	5	2	2	-	-	-	3	-	4	2	1	27	--	27	2.25

#	Phases 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total (+)	Total (-)	Total Net	Average
22	-1	1	2	1	-2	3	-1	2	2	1	-	4	-	3	1	2	22	-4	18	1.29
23	1	0	4	1	1	5	3	3	0	2	-	4	-	7	0	2	33	--	33	2.36
24	0	1	2	-1	0	3	5	4	0	2	2	-	2	4	-	-	25	-1	24	1.85
25	1	2	5	1	2	3	3	4	1	3	-	4	-	5	1	1	36	--	36	2.67
26	-1	-2	-1	1	-1	1	2	1	0	3	-	3	-	3	-2	1	15	-7	8	0.57
27	-1	4	4	3	1	8	6	2	-2	2	-	1	-	7	0	2	40	-3	37	2.64
28	1	2	2	3	-3	-2	2	2	3	2	-2	4	-	2	2	2	27	-7	20	1.33
29	2	2	5	3	3	8	7	6	3	4	7	-	6	7	4	0	67	--	67	4.46
30	3	3	5	3	4	7	7	5	-	2	7	-	5	7	4	2	64	--	64	4.57
31	-1	0	0	2	-3	-2	-2	2	-1	1	4	-1	3	2	3	-1	17	-11	6	0.38
32	0	2	4	3	0	2	2	2	0	0	-	1	-	4	0	0	20	--	20	1.43
33	0	4	4	1	1	7	0	0	4	1	-	4	-	8	-	3	37	--	37	2.84
34	2	2	3	3	1	5	5	6	0	3	-	3	-	9	2	2	46	--	46	3.29
35	-1	0	5	3	0	2	1	4	-1	3	-	3	-	3	0	0	24	-2	22	1.57
36	3	3	6	2	2	7	7	6	7	4	3	-	4	1	5	1	61	--	61	4.06
37	0	0	4	2	2	0	0	3	0	2	-	1	-	5	-1	0	19	-1	18	1.29
38	1	3	5	3	4	5	7	4	2	4	-	5	-	4	3	1	51	--	51	3.64
39	0	-2	2	0	3	3	4	4	2	0	-	1	-	4	0	0	23	-2	21	1.50
40	2	2	4	0	0	3	2	5	0	0	-	3	-	2	0	2	25	--	25	1.79
41	-3	-2	2	3	-2	1	4	1	0	1	-	1	-	2	2	1	18	-7	11	0.79
42	3	2	5	3	0	4	2	4	2	4	-	4	-	6	4	1	44	--	44	3.14
43	4	4	5	3	4	3	2	3	3	2	1	-	2	9	5	2	52	--	52	3.47
44	2	3	7	4	1	7	4	-	1	2	5	-	2	5	-	1	44	--	44	3.39

#	Phases 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total (+)	Total (-)	Total Net	Average
45	2	2	2	2	3	6	4	4	3	1	-	2	-	8	3	3	45	--	45	3.21
46	0	2	4	2	1	5	0	1	0	1	-	0	-	4	1	0	21	--	21	1.50
47	3	4	5	1	1	5	3	6	3	3	4	5	4	7	5	3	62	--	62	3.88
48	3	2	5	2	0	6	7	4	4	3	-	3	-	6	3	2	50	--	50	3.67
49	3	2	5	3	-1	-4	0	2	0	1	-	4	-	4	4	1	29	-5	24	1.72
50	3	2	-4	3	-1	3	8	3	2	2	-	-	6	9	3	2	46	-5	41	2.93
51	0	-1	4	1	5	6	6	1	1	3	5	-	3	4	-	0	39	-1	38	2.72
52	1	3	4	3	3	5	0	5	0	0	-	1	-	3	1	1	30	--	31	2.14
53	-1	1	3	4	0	4	0	5	0	0	-	2	-	2	0	1	22	-1	21	1.50
54	2	2	6	2	3	8	6	5	3	4	-	3	-	8	4	3	59	--	59	4.20
55	0	2	5	-1	3	1	2	-1	0	2	1	-	2	5	3	2	28	-2	26	1.73
56	2	3	5	2	3	7	5	2	1	3	-	3	-	5	2	2	45	--	45	3.21
57	-2	3	1	2	-2	-3	-1	6	-1	1	-	2	-	3	1	1	20	-9	11	0.79
58	0	1	2	2	-1	1	1	2	-2	1	-	2	-	4	1	2	19	-3	16	1.14
59	4	4	2	3	2	2	5	2	0	2	-	2	-	1	3	1	33	--	33	2.36
60	-	2	3	3	1	7	5	3	2	2	-	2	-	8	1	3	42	--	42	3.24
61	0	-2	4	3	4	4	4	6	1	1	-	1	-	2	3	2	35	-2	33	2.35
62	2	2	3	2	-1	2	3	0	-1	-1	-	2	-	4	0	2	22	-3	19	1.36
63	2	4	6	4	1	5	6	5	3	3	8	-	3	7	5	2	64	--	64	4.26
64	2	3	4	3	1	6	6	6	5	4	7	-	4	6	3	2	62	--	62	4.13
65	-2	-3	4	2	5	-2	1	-	-	4	-	1	-	1	2	2	22	-7	15	1.25
66	2	4	6	4	3	6	8	5	2	4	-	5	-	9	3	3	64	--	64	4.57
67	3	4	6	2	1	7	4	4	5	3	-	4	-	1	4	3	51	--	51	3.64

#	Phases 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total (+)	Total (-)	Total Net	Average
68	-1	-1	-3	2	-6	-1	-4	6	-2	1	-	-1	-	2	-	1	12	-19	- 7	-0.54
69	0	0	6	3	3	4	1	3	-2	0	0	-	-2	0	1	1	22	-4	18	1.20
70	0	3	3	2	4	4	1	0	5	2	-	1	-	4	2	-2	31	-2	29	2.07
71	-4	-2	-1	0	-6	-5	-2	1	-2	1	-2	-3	-4	-7	2	0	4	-38	-34	-2.12
72	-1	-1	4	3	-2	1	0	2	-2	4	0	-	-1	3	3	2	22	-7	15	1.00
73	2	3	6	4	6	8	8	5	5	5	-	5	-	6	4	2	69	--	69	4.93
74	3	4	4	3	2	4	3	4	3	3	-	4	-	7	3	3	50	--	50	3.57
75	1	-1	-1	1	-6	-1	-1	3	-3	1	-1	-	2	1	-1	1	10	-15	-5	-0.33
76	2	2	4	2	-1	4	2	5	1	0	0	-	3	1	1	1	28	-1	27	1.80
77	3	3	4	3	2	3	5	6	5	4	7	-	2	8	4	2	61	--	61	4.07
78	2	2	5	1	0	2	2	-1	0	0	-	1	-	1	3	1	20	-1	19	1.36
79	1	1	4	3	2	3	5	3	2	2	-	2	-	4	3	1	36	--	36	2.57
80	2	3	5	3	1	5	4	4	1	3	-	4	-	5	4	1	45	--	45	3.21
81	1	1	4	2	3	6	6	1	2	5	-	5	-	8	4	2	50	--	50	3.57
82	1	2	5	0	-1	5	1	2	-1	2	-	3	-	4	1	2	28	-2	26	1.86
83	0	0	4	2	2	1	3	5	0	1	-	-1	0	3	0	0	21	-1	20	1.33
84	-4	1	1	1	0	5	1	2	2	2	2	-	5	3	-1	-1	25	-6	19	1.27
85	4	4	5	4	3	4	1	5	-1	3	3	-	4	7	5	2	58	-1	57	3.13
86	3	4	4	2	3	3	5	5	5	4	-	4	-	6	4	2	54	--	54	3.86
87	3	4	5	2	3	4	1	3	3	3	-	2	-	4	5	3	45	--	45	3.21
88	3	4	5	2	2	4	4	3	4	4	-	5	-	7	3	0	50	--	50	3.57
89	-1	1	3	3	3	1	-1	1	0	-1	-	0	-	2	0	0	14	-3	11	0.79

#	Phases 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total (+)	Total (-)	Total Net	Average
90	-1	1	4	3	1	1	0	3	0	-1	-	1	-	-1	0	0	14	-3	11	0.79
91	0	2	2	3	-1	3	2	5	1	1	4	2	3	4	0	1	33	-1	32	2.00
92	1	3	5	1	2	6	5	3	3	2	6	-	4	8	2	2	53	--	53	3.53
93	1	2	2	1	-3	3	3	2	1	1	-	1	-	0	1	1	19	-3	16	1.14
94	2	0	0	2	-2	1	0	0	4	3	5	0	4	2	2	-1	25	-3	22	1.47
95	-3	0	-1	-1	-3	0	3	3	0	2	-1	-	-4	-8	-4	2	10	-25	-15	-1.00
96	0	3	4	1	-1	1	-2	-2	-1	-1	-1	-	0	3	2	2	16	-8	8	0.53
97	0	1	4	1	1	3	3	4	0	0	-	0	-	4	0	0	21	0	21	1.50

AVIATOR FLIGHT EVALUATION DATA AGGREGATED CATEGORY SCORES

*Prop: proportions of possible scores normalized using the sum of the maximum possible positive score in each subcategory, 1 through 16.

	Preflight		Fundamentals		Climbs		Enroute		Letdowns		Other	
#	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.
2	2	0.250	10	0.400	-2	-0.143	4	0.286	0	0.000	2	0.667
3	3	0.376	3	0.120	-2	-0.143	2	0.143	11	0.333	2	0.557
4	0	0.000	1	0.040	1	0.071	4	0.286	4	0.121	2	0.667
5	3	0.376	11	0.440	8	0.572	9	0.643	3	0.231	1	0.333
6	4	0.500	9	0.359	1	0.071	6	0.428	9	0.321	3	1.000
7	8	1.000	24	0.960	14	1.000	14	1.000	28	1.000	3	1.000
8	6	0.750	14	0.561	1	0.071	4	0.286	6	0.316	1	0.333
9	3	0.376	9	0.359	1	0.071	2	0.143	3	0.158	3	1.000
10	7	0.875	20	0.800	6	0.428	6	0.428	15	0.790	3	1.000
11	4	0.500	17	0.680	11	0.786	8	0.572	26	0.929	2	0.667
12	3	0.376	15	0.600	3	0.214	2	0.143	8	0.320	2	0.667
13	1	0.125	9	0.359	1	0.071	1	0.071	8	0.727	-1	-0.333
14	-2	-0.250	14	0.561	0	0.000	4	0.286	9	0.474	2	0.667
15	4	0.500	18	0.721	4	0.286	9	0.643	18	0.948	2	0.667
16	7	0.875	10	0.400	11	0.786	10	0.715	8	0.286	1	0.333
17	6	0.750	10	0.400	6	0.428	8	0.572	4	0.210	2	0.667
18	4	0.500	14	0.561	2	0.143	2	0.143	8	0.286	1	0.333
19	4	0.400	7	0.280	0	0.000	5	0.357	3	0.158	2	0.667
20	6	0.750	11	0.440	1	0.071	6	0.428	6	0.316	1	0.333

*Prop.: proportions of possible scores normalized using the sum of the maximum possible positive score in each subcategory, 1 through 16.

	Preflight		Fundamentals		Climbs		Enroute		Letdowns		Other	
#	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop	Score	*Prop.
21	3	0.376	11	0.440	0	0.000	5	0.555	7	0.369	1	0.333
22	0	0.000	7	0.280	0	0.000	4	0.286	5	0.263	2	0.667
23	1	0.125	12	0.480	1	0.071	7	0.500	10	0.527	2	0.667
24	1	0.125	5	0.250	0	0.000	5	0.357	13	0.685	-	-
25	3	0.376	12	0.480	3	0.214	6	0.428	11	0.579	1	0.333
26	-3	-0.376	1	0.040	-1	-0.071	4	0.286	6	0.316	1	0.333
27	3	0.376	14	0.561	-1	-0.071	10	0.715	9	0.474	2	0.667
28	3	0.376	9	0.359	0	0.000	0	0.000	6	0.222	2	0.667
29	4	0.500	19	0.760	6	0.428	12	0.858	26	0.929	0	0.000
30	6	0.750	19	0.760	4	0.572	9	0.643	24	0.858	2	0.667
31	-1	-0.125	7	0.280	-4	-0.286	-1	-0.071	6	0.182	-1	-0.333
32	2	0.250	11	0.440	0	0.000	2	0.143	5	0.263	0	-0.000
33	4	0.500	13	0.650	5	0.357	8	0.572	4	0.210	3	1.000
34	4	0.500	17	0.680	1	0.071	8	0.572	14	0.737	2	0.667
35	-1	-0.125	11	0.440	-1	-0.071	5	0.357	8	0.421	0	0.000
36	6	0.750	14	0.561	9	0.643	11	0.786	20	0.715	1	0.333
37	0	0.000	10	0.400	2	0.143	2	0.143	4	0.210	0	0.000
38	4	0.500	15	0.600	6	0.428	9	0.643	16	0.843	1	0.333
39	-2	-0.250	6	0.240	5	0.357	3	0.214	9	0.474	0	0.000
40	4	0.500	6	0.240	0	0.000	3	0.214	10	0.527	2	0.667
41	-5	-0.625	9	0.359	-2	-0.143	2	0.143	6	0.316	1	0.333

*Prop.: proportions of possible scores normalized using the sum of the maximum possible positive score in each subcategory, 1 through 16.

	Preflight		Fundamentals		Climbs		Enroute		Letdowns		Other	
#	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.
42	5	0.625	18	0.721	2	0.143	8	0.572	10	0.527	1	0.333
43	8	1.000	22	0.881	7	0.500	5	0.357	8	0.286	2	0.667
44	5	0.625	16	0.800	2	0.143	9	0.643	11	0.500	1	0.333
45	4	0.500	15	0.600	6	0.428	7	0.500	10	0.527	3	1.000
46	2	0.250	11	0.440	1	0.071	6	0.428	1	0.053	0	0.000
47	7	0.875	18	0.721	4	0.286	8	0.572	22	0.333	3	1.000
48	5	0.625	16	0.640	4	0.286	9	0.643	14	0.737	2	0.667
49	5	0.625	16	0.640	-1	-0.071	-3	-0.214	6	0.316	1	0.333
50	5	0.625	11	0.440	1	0.071	5	0.357	17	0.850	2	0.667
51	-1	-0.125	9	0.450	6	0.428	9	0.643	15	0.537	0	0.000
52	4	0.500	11	0.440	3	0.214	5	0.357	6	0.316	1	0.333
53	0	0.000	9	0.359	0	0.000	4	0.286	7	0.369	1	0.333
54	4	0.500	20	0.800	6	0.428	12	0.858	14	0.737	3	1.000
55	2	0.250	12	0.480	3	0.214	3	0.214	4	0.143	2	0.667
56	5	0.625	14	0.561	4	0.286	10	0.715	10	0.527	2	0.667
57	1	0.125	7	0.280	-3	-0.214	-2	-0.143	7	0.368	1	0.333
58	1	0.125	9	0.359	-3	-0.214	2	0.143	5	0.263	2	0.667
59	8	1.000	9	0.359	2	0.143	4	0.286	9	0.474	1	0.333
60	2	0.500	15	0.600	3	0.214	9	0.643	10	0.527	3	1.000
61	-2	-0.250	12	0.480	5	0.357	5	0.357	11	0.579	2	0.667

*Prop.: proportions of possible scores normalized using the sum of the maximum possible positive score in each subcategory, 1 through 16.

	Preflight		Fundamentals		Climbs		Enroute		Letdowns		Other	
#	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.
62	4	0.500	9	0.359	-2	-0.143	1	0.071	5	0.263	2	0.667
63	6	0.750	22	0.881	4	0.286	8	0.572	22	0.786	2	0.667
64	5	0.625	16	0.640	6	0.428	10	0.715	23	0.822	2	0.667
65	-5	-0.625	9	0.359	5	0.715	2	0.143	2	0.154	2	0.667
66	6	0.750	22	0.881	5	0.357	10	0.715	18	0.948	3	1.000
67	7	0.875	13	0.520	6	0.428	10	0.715	12	0.632	3	1.000
68	-2	-0.250	1	0.050	-8	-0.572	0	0.000	1	0.053	1	0.333
69	0	0.000	10	0.400	1	0.071	4	0.286	2	0.072	1	0.333
70	3	0.376	11	0.440	9	0.643	6	0.428	2	0.105	-2	-0.667
71	-6	-0.750	-6	-0.240	-8	-0.572	-4	-0.286	-10	-0.303	0	0.000
72	-2	-0.250	13	0.520	-4	-0.286	5	0.357	1	0.036	2	0.667
73	5	0.625	20	0.800	11	0.786	13	0.930	18	0.948	2	0.667
74	7	0.875	17	0.680	5	0.357	7	0.500	11	0.612	3	1.000
75	0	0.000	0	0.000	-9	-0.643	0	0.000	3	0.091	1	0.333
76	4	0.500	8	0.320	0	0.000	4	0.286	10	0.357	1	0.333
77	6	0.750	19	0.760	7	0.500	7	0.500	20	0.715	2	0.667
78	4	0.500	10	0.400	0	0.000	2	0.143	2	0.105	1	0.333
79	2	0.250	14	0.561	4	0.286	5	0.357	10	0.527	1	0.333
80	5	0.625	17	0.680	2	0.143	8	0.572	12	0.632	1	0.333
81	2	0.250	18	0.721	5	0.357	11	0.786	12	0.632	2	0.667

*Prop.: proportions of possible scores normalized using the sum of the maximum possible positive score in each subcategory, 1 through 16.

	Preflight		Fundamentals		Climbs		Enroute		Letdowns		Other	
#	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.	Score	*Prop.
82	3	0.376	10	0.400	-2	-0.143	7	0.500	6	0.316	2	0.667
83	0	0.000	9	0.359	2	0.143	2	0.143	7	0.280	0	0.000
84	-3	-0.376	4	0.160	2	0.143	7	0.500	10	0.357	-1	-0.333
85	8	1.000	21	0.841	2	0.143	7	0.500	13	0.464	2	0.667
86	7	0.875	16	0.640	8	0.572	7	0.500	14	0.737	2	0.667
87	7	0.875	16	0.640	6	0.428	7	0.500	6	0.316	3	1.000
88	7	0.875	17	0.680	6	0.428	8	0.572	12	0.632	0	0.000
89	0	0.000	8	0.320	3	0.214	0	0.000	0	0.000	0	0.000
90	0	0.000	6	0.240	1	0.071	0	0.000	4	0.210	0	0.000
91	2	0.250	9	0.359	0	0.000	4	0.286	16	0.485	1	0.333
92	4	0.500	16	0.640	5	0.357	8	0.572	18	0.643	2	0.667
93	3	0.376	4	0.160	-2	-0.143	4	0.286	6	0.316	1	0.333
94	2	0.250	6	0.240	2	0.143	4	0.286	9	0.321	-1	-0.333
95	-3	-0.376	-14	-0.561	-3	-0.214	2	0.143	1	0.036	2	0.667
96	3	0.376	10	0.400	-2	-0.143	0	0.000	-5	-0.151	2	0.667
97	1	0.125	9	0.360	1	0.715	3	0.212	7	0.369	0	0.000

BIBLIOGRAPHY

I. Official Correspondence and Directives

1. Chief of Naval Operations message concerning leased jet contract, 101734Z February 1970.

2. Chief of Naval Operations message concerning CRT study requirement, 141612Z March 1970.

3. Deputy Assistant Secretary of Defense (Manpower Research and Utilization), letter to the General Accounting Office concerning air operations at Naval Auxiliary Landing Field, Monterey (OSD Case #2974), 9 February 1970.

4. Superintendent, Naval Postgraduate School, message to CNO concerning CRT study requirements, 241820Z March 1970.

5. Superintendent, Naval Postgraduate School, letter report to CNO concerning the CRT program, dated 14 May 1970.

6. OPNAVINST 3710.7D. *NATOPS Manual, General Flight and Operating Instructions*. Chief of Naval Operations, Washington, D. C., 1967. (Provides very broad guidance concerning all naval flight operations.)

7. Department of Defense, *Military Pay and Allowances, Entitlement Manual*, Department of Defense, Washington, D. C., 1970. (Outlines and describes various pay and entitlement thereto.)

8. Congress of the United States, *Career Compensation Act of 1948, as amended by the Military Pay Act of 1958*, Public Law 85-442, 72, Statute 122.

9. United States Code of Federal Regulations, Title 3, The President. *Regulations Relating to the Right of Members of the Uniformed Services to Incentive Pay for the Performance of Hazardous Duty Required by Competent Orders*. 1949-1953 Compilation. Executive 10152, 17 August 1950, Washington, D. C.: U. S. Government Printing Office, 1958.

10. Chief of Naval Operations message concerning annual minimum flight requirements FY-71, 291640Z June 1970.

II. Flight Proficiency

11. Advisory Group for Aerospace Research and Development. *Assessment of Skill and Performance in Flying*. AGARD Conference Proceedings No. 14, Paris: North Atlantic Treaty Organization, 1966. (Sophisticated but helpful papers on the subject. Indicates value of AGARD as a source.)

12. Allen, C. P., D. Blaine, and M. Danoff. *Proficiency Flying Program Study: II -- Pilot Performance Analysis*. Technical Advisement Memorandum No. 133-2. PRCD-1349. Los Angeles: Planning Research Corporation, 1966. (Supporting document for Caines' PRC Study.)

13. Barton, R., *et. al., Proficiency Flying at the Naval Postgraduate School, Monterey*. Unpublished staff study prepared for a Conference Procedures class at the Naval Postgraduate School, 16 March 1970. (Conclusions: (1) Typical NPS aviator is virtually identical to his CRT neophyte counterpart.)

14. Bowen, H. M., *et. al., Study, Assessment of Pilot Proficiency*. Technical Report, NAVTRADEVCEN 1614-1, Port Washington, New York: Dunlap & Associates, Incorporated, 1966. (Good study of subject in Operational Flight Trainer (OFT) for the A-4 airplane. Points out need for credibility and multiplicity of tasks. Bibliography.)

15. Caines, K. L. D., and M. N. Danoff. *Proficiency Flying Program Study*. PRC R-952. Los Angeles: Planning Research Corporation, 1967. ("The PRC Study" is the best look at the CRT problem. Must reading.)

16. Colman, K. W., *et. al., The Operational Flight Trainer in Aviation Safety*. U. S. Naval Training Device Center, Port Washington, New York, 1962. (Found that the OFT contributed to the elimination of those safety factors associated with human error.)

17. Danoff, M. N. *Proficiency Flying Program Study: I -- Pilot Performance Data Collection*, Technical Advisement Memorandum No. 133-1. PRC D-1320. Los Angeles: Planning Research Corporation, 1966. (This document supports "The PRC Study," Caines.)

18. Dougherty, D. J. *Transfer of Training in Flight Procedures from Selected Ground Training Devices to the Aircraft*. Technical Report NAVTRADEVCEN 71-16-16. Port Washington, New York: U. S. Naval Training Device Center, 1957. (Found significant transfer of training; the more sophisticated the trainer the more transfer. An OFT is as good as aircraft. Training in procedures does not adversely affect performance on flight tasks.)

19. Dunn, R. F. *An Analysis of the Value of Naval Air Combat Readiness Training*. Naval Postgraduate School, Monterey, California, 1964. Unpublished Master's thesis. (An interesting treatise on many of the variables identified in CRT/proficiency flying. Good background reading.)

20. Ellis, N. C., *et. al., Pilot Performance, Transfer of Training and Degree of Simulation: III, Performance of Non-jet Experienced Pilots vs. Simulation Fidelity*. Technical Report, NAVTRADEVCEN 67-C-0034-1. Orlando, Florida: U. S. Naval Training Device Center, 1968. (One of a series. Not much help in itself because of its limited scope, but the entire series must be an input to the recommendation concerning the optimum CRT program mix among flight, school and simulation.)

21. Erickson, S. C. *A Review of the Literature on Methods of Measuring Pilot Proficiency*. Human Resources Research Center, Research Bulletin 52-25. Sheppard Air Force Base, Texas: Air Training Command, 1952. (Traces development of psychological and other methods of measuring pilot proficiency for grading, selecting, etc.)

22. Goodwin, C. T., *et. al., Proficiency Flying*. Unpublished staff study (File No. 2710), Naval Postgraduate School, Monterey, California, 20 March 1969. (Conclusions: (1) Increased utilization of aircraft at NALF is possible; (2) maintenance policies need updating; (3) a ground school is needed for new pilots.)

23. Hatch, R. *An Evaluation of the Effectiveness of a Self-Tutoring Device Applied to Pilot Training*. Technical Report 59-320. Columbus, Ohio: Air Research and Development Command, 1959. (Found that a machine quiz situation could be used to provide self-tutoring of knowledge about aircraft, aerodynamics, instruments, etc.)

24. Kearley, J., *et. al., SP 1021-1, Group Bravo Class Project*. An Evaluation of Naval Postgraduate School aviators on proficiency flying, Naval Postgraduate School, Monterey, California, 14 March 1970. (Conclusions: (1) NFO's do not wish to continue CRT flying at NPGS; (2) no such conclusions for aviators; (3) opinions not altered by leased jet.)

25. Krendel, E. S., and J. W. Bloom. *The Natural Pilot Model for Flight Proficiency Evaluation*. Technical Report, NAVTRADEVCEN 323-1. Port Washington, New York: U. S. Naval Training Device Center, 1963. (Approached problem by separating the "mechanical pilot" from the "natural pilot" in an attempt to identify the relevant factors that characterize pilot proficiency. Took a systems or servo-mechanism feedback approach to problem. Highly theoretical.)

26. Krendel, E. S., and B. L. Ryack. *Experimental Study of the Natural Pilot Flight Proficiency Evaluation Model.* Technical Report NAVTRADEVCEN 323-2. Port Washington, New York: U. S. Naval Training Device Center, 1963. (More theory and some experimentation on the subject, emphasis on adaptability and economy of effort.)

27. Kusewitt, J. B. *Combat Readiness Training (CRT) Study.* (Confidential) Dallas, Texas: LTV Aerospace Corporation, 1968. (Research effort that hangs entirely on an opinion questionnaire gathered on USN/USMC pilots on CRT flying. Assessed the career intentions of those officers and attempted to justify the Navy's CRT program in the costs that would be incurred to train their replacements. Summarized in March 1970 issue of *Naval Institute Proceedings.*)

28. Kusewitt, J. B., and W. A. Speer, "Combat Readiness Training," *U. S. Naval Institute Proceedings,* Vol. 96, No. 3/805, March 1970. (Inflation or recession aside, there is reason to believe that a dollar spent today in improving the Navy's CRT program will produce value benefits worth almost six times as much.)

29. Naval Training Device Center. *The Forgetting of Instrument Flying Skills as a Function of the Level of Initial Proficiency.* Technical Report NAVTRADEVCEN 71-16-18. Port Washington, New York, circa 1959. (OFT experiment showed forgetting of discrete procedural tasks was worse than that of continuous flight control. Bibliography.)

30. Smith, J. F., R. E. Flexman, and R. C. Houston. *Development of an Objective Method of Recording Flight Performance.* Technical Report 52-15. Sheppard Air Force Base, Texas: Air Training Command, 1952. (Task oriented research. Old and outdated. Difficult to control observer bias and difficult to score.)

31. Soliday, S. M., and B. Schohan. *A Simulator Investigation of Pilot Performance During Extended Periods of Low Altitude, High Speed Flight.* Washington, D. C.: North American Aviation, NASA, 1964. (NASA CR-63).

32. Speiser, Jack E. *A Current Look at Proficiency Flying.* Thesis, Naval Postgraduate School, Monterey, California, May 1962. (A review of proficiency flying at the Naval Air Facility, Monterey. Emphasis placed on developing a coordinated flying and non-flying training program in which the proficiency of the aviator might be improved.)

33. Wright Aerospace Medical Division. *The Measurement of Advanced Flight Vechicle Crew Proficiency in Synthetic Ground Environments*. 6570. Aerospace Medical Research Laboratories, Report No. MRL-TDR-62-2. Wright-Patterson Air Force Base, Dayton, Ohio, 1962. (Pertains primarily to spacecraft manipulation and measures of pilot proficiency in same. Points up the fact that adequate trainers must become more expensive and complex as the mission or vehicle becomes more complex. Refers also to jet aircraft pilot trainers.)

34. White, Charles E. "Combat Readiness Training", Letter to the Editor, *Naval Institute Proceedings*, July 1970. (Critique of the LTV Study as published in March *Proceedings*.)

III. Human Factors

35. Clark, B. *A Note on the Expressed Reasons for Duty in Jet Aircraft*. USN SCHAVMED, Project No. 001 109 100, Report No. 12. Pensacola, Florida: U. S. Naval School of Aviation Medicine, 1956. (Questionnaire given to 109 jet pilots. Asked why they liked to fly jets. Results: high performance aircraft, comfort, sense of accomplishment, prestige, and easier to fly.)

36. Clary, James N. *Officer Personnel Costs*. Aviation Officer Candidate. Washington, D. C.: Naval Personnel Research Laboratory, July 1965. (WRM No. 66-1.) (The third in a series of reports on officer personnel costs. Breaks down all costs of training for different types of pilots. Good -- but out of date at today's ratios - $.)

37. Goldhamer, Herbert. *Human Factors in Systems Analysis*. RM-388. Santa Monica, California: The RAND Corporation, 15 April 1950. (DDC No. AD178026.)

38. Harding, F. D. *A Survey of Incentives for Hazardous or Unpleasant Working Conditions*. Document No. 132 240. Denver, Colorado: Air Force Personnel and Training Research Center, 1957. (Studied nuclear reactor workers. Incentives are basically money plus some fringe benefits. Does not address flying. Most companies, with pressures from unions, establish higher basic rates of pay rather than pay incentives.)

39. Kelly, K. P. *An Exploratory Study of Attitudes Toward Flying*. Research Bulletin 54-100. Denver, Colorado: Air Force Personnel and Training Research Center, 1954. (Conducted an attitude survey among Air Force ROTC students. Concluded that people are drawn toward flying and those who express a desire not to fly do so because of ear, etc., and not because they are expecially drawn toward a ground job. Reasons for not flying are: non-career, fear.)

40. *Modernizing Military Pay.* Report of the First Quadrennial Review of Military Compensation (Hubbell Report), Vols. I-V, 1 November 1967. (Vol. I, p. 102: Evaluation of existing special pays. Good direction on reasons for pay distinctions. Vol II, p. 52: Analysis of distribution of Navy pilots in civilian occupations. At that time 16% of Navy pilots that got out went with civilian airlines as pilots.)

41. Richey, H. W., and F. R. Ratliff. *The Prestige of Air Force Career Fields.* Development Report 56-78. Denver, Colorado: Air Force Personnel and Training Research Center, 1956. (Does not address either officers or flying.)

42. *Secretary of the Navy's Task Force on Navy/Marine Corps Personnel Retention.* Washington, D. C.: Department of the Navy, Vols. 1-11, 25 January 1966. (Vol. 2, SECRET, S103159; Vols. 1, 3-11, VB 258.U69; Vol. 10, Summary of measurement methods and criteria that were developed in support of cost per productive manhour model. p. 24, Flight Training Data based on FY-64 ($97,895).)

43. Stockstill, L., and J. Hesman. "The Hubbell Report," *Journal of the Armed Forces,* 4 May 1968. (Finding: Pay distinctions other than those in salary table are justified only: (1) to meet hard retention or manning requirements; (2) to secure requisite numbers of volunteers for special duties; (3) to compensate for unusually arduous or dangerous conditions of service. Recommendation: Hazardous duty incentive pay should remain fixed at existing rates, until evaluation of effects of salary system.)

44. Switzer, R. E. *The Human Side of Aircraft Accidents.* Air Force Directorate of Flight Safety Research, Publication M-36. Washington, D. C.: Air Systems Command, 1951. (Found that pilot errors caused 55% of all aircraft accidents in the following proportions: judgment, 60%; attention, 20%; manipulation, 15%. Stated that lack of knowledge is the basic cause of accidents.)

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13. ABSTRACT

Methods were developed for the collection of data with respect to the knowledge, skill, and satisfaction of aviators in combat readiness training (CRT). The methods are described and data pertaining to aviators flying the T-1A aircraft at the rate of forty-eight hours per year is given.

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